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HOVEY WILLIAMS LLP
2405 GRAND BLVD., SUITE 400
KANSAS CITY, MO 64108

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/066,277
Filing Date: February 01, 2002
Appellant(s): CAVE ET AL.

Thomas B. Luebbering
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 12/30/2005 appealing from the Office action mailed 6/30/2005.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is substantially correct. (Claims 5 and 27 have been rejected over Esrig in view of Jaber, not claims 5 and 7).

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

Claims 5 and 27 stand rejected under 35 USC § 103(a) as being unpatentable over Esrig in view of Jaber.

(7) Claims Appendix

A substantially correct copy of appealed claims 1-42 appears on pages 30-41 of the appellant's brief. The minor errors are as follows:

In line 6 of claim 14, the phrase "so as to enhance surface a contrast" should read -- so as to enhance a contrast --.

In lines 12-13 of claim 23, the phrase "to allow for the evaluation of the sample" should be removed.

In line 7 of claim 34, the phrase "so as to enhance surface a contrast" should read -- so as to enhance a contrast --.

In line 13 of claim 34, the phrase "to allow for the evaluation of the sample" should be removed.

(8) Evidence Relied Upon

4,755,874	ESRIG et al.	7-1988
6,748,110	WALLACK	6-2004
5,768,412	MITSUYAMA et al.	6-1998
6,151,408	OOSAWA	11-2000
5,262,967	JABER et al.	11-1993

Cho et al. "Feature extraction using Fuzzy Relations for Objects of Various Shapes" IEEE Conference on Systems, Man, and Cybernetics, vol. 1 (1996), pp. 272-275.

(9) Grounds of Rejection

The following grounds of rejection are applicable to the appealed claims (copied from the Final Rejection mailed 6/30/2005):

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-4, 6, 7, 8, 23-26, and 28 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 4,755,874 by Esrig et al. ("Esrig").

Regarding claims 1 and 23, Esrig discloses a method/system (figure1) operable to substantially automatically perform an evaluation of a sample of a material according to an established standard, wherein the system comprises:

a microscope (11) operable to magnify the sample;

a light source (29) operable to illuminate the sample, wherein the illumination is provided at a grazing angle so as to enhance a contrast between surface features of the sample;

a stage (9) associated with the microscope and operable to move and position the sample under the microscope for viewing;

an image capturing mechanism (13) operable to capture an image of the sample through the microscope; and

a computing device ("image computer") operable to control magnification by the microscope, control illumination by the light source, receive images from the image capturing device, control movement of the stage, and store and execute a computer program operable to substantially automatically conduct an analysis (see e.g. figures 4 and 5) of the image to identify surface features of the sample and determine characteristics of the sample therefrom, and to generate a report setting forth a result of the analysis.

Regarding claims 2 and 24, Esrig disclsoes the analysis includes identification and measurement of one or more components of the sample (see figures 4 and 5).

Regarding claims 3 and 25, Esrig discloses the analysis includes identification and measurement of one or more physical features of the sample (see figures 4 and 5).

Regarding claims 4 and 26, Esrig discloses the sample is prepared prior to being magnified by the microscope, wherein such preparation facilitates the analysis (e.g. the sample is properly positioned on the stage).

Regarding claim 6, Esrig discloses the image capturing mechanism is a CCD camera (see column 4, lines 63-68).

Regarding claims 7 and 28, Esrig discloses the stage is a high-precision two-dimensional stage controlled by the computing device to avoid overlapping fields-of-view (column 4, lines 51-54: the stage 9 moves the module 23 so the objects under inspection are completely within the view of the camera 13 and there is no overlap between the field-of-view of the camera and that of the objects).

Regarding claim 8, Esrig discloses the computer program provides a graphical user interface operable to facilitate a user setting up and initiating the analysis, and to facilitate the user causing the report to be generated (monitor 15 provides a GUI).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 5 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esrig in view of U.S. Patent 5,262,967 by Jaber et al. ("Jaber").

Regarding claims 5 and 27, Esrig does not disclose that the material is concrete and the sample is prepared in accordance with the established standard prior to being magnified by the microscope, wherein such preparation includes polishing a face of the sample, and the analysis includes identifying and measuring a number of voids in the sample.

Jaber discloses a system for inspecting an image of a sample of concrete. In particular, Jaber discloses washing, scrubbing, polishing, etc. the sample of concrete (column 3, lines 36-

42) and then identifying and measuring a number of voids in the sample (see column 2, lines 32-49).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Esrig by Jaber to inspect concrete as claimed, since Jaber discloses that it is conventional to inspect concrete for quality control purposes.

6. Claims 17 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esrig in view of Wallack and Mitsuyama, and further in view of U.S. Patent 5,262,967 by Jaber et al. ("Jaber").

Regarding claims 17 and 37, Esrig does not disclose that the material is concrete and the sample is prepared in accordance with the established standard prior to being magnified by the microscope, wherein such preparation includes polishing a face of the sample, and the analysis includes identifying and measuring a number of voids in the sample.

Jaber discloses a system for inspecting an image of a sample of concrete. In particular, Jaber discloses washing, scrubbing, polishing, etc. the sample of concrete (column 3, lines 36-42) and then identifying and measuring a number of voids in the sample (see column 2, lines 32-49).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Esrig by Jaber to inspect concrete as claimed, since Jaber discloses that it is conventional to inspect concrete for quality control purposes.

7. Claims 9-11, 14-16, 18-20, 29-31, 34-36, 38-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esrig in view of U. S Patent 6,748,110 by Wallack and U.S. Patent 5,768,412 by Mitsuyama.

Regarding claims 9, 29, 14, and 34, Esrig discloses the method/system of claim 1, wherein the computer program performs a number of different image analysis techniques on the image, including—

a intensity profile segmentation and recognition technique operable to identify a unique characteristic of a profile of the object (figure 4 illustrates an intensity profile that identifies unique characteristics of the object).

Esrig does not appear to disclose a color segmentation and recognition technique operable to facilitate identification and classification of an object in the image, and to differentiate the object from other objects in the image; and

a shape feature segmentation and analysis technique operable to extract the object from the image and to characterize a shape of the object.

Wallack discloses a system for extracting objects from an image of a sample to be inspected. In particular, Wallack discloses performing a segmentation and recognition technique (figure 2) that identifies, classifies, and differentiates objects in the image, as well as characterizing their shapes. For example, figure 3 shows a "blob" of image data being extracted from the sample. The blob is segmented from the rest of the sample and its shape, among other things, is ascertained (see column 4, lines 45-49; column 10, lines 6-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Esrig by Wallack to provide a segmentation and recognition technique and a shape feature segmentation and analysis technique, since Wallack shows that such techniques are advantageous for identifying and characterizing objects in samples under inspection and provides more data with which to inspect the samples.

Wallack does no expressly disclose that the segmentation is "color" segmentation. Wallack appears to process greyscale images. However, at the time the invention was made, Mitsuyama shows that it was well-known and obvious to those skilled in the art that region segmentation is applicable to color images, such as those containing separate red, green, and blue signals, and segmentation is advantageously effected on the basis of color.

Regarding claims 10, 30, 19, and 39, Mitsuyama discloses color segmentation and recognition technique is based on RGB (see column 4, lines 55-67).

Regarding claims 11, 31, 20, and 40, Wallack discloses the segmentation and recognition technique uses a nearest neighbor technique to identify and classify the object (column 8, lines 22-40: the nearest neighbors of an object pixel are examine to identify and classify a blob).

Regarding claims 15 and 35, Esrig disclsoes the analysis includes identification and measurement of one or more components of the sample (see figures 4 and 5).

Regarding claims 16 and 36, Esrig discloses the analysis includes identification and measurement of one or more physical features of the sample (see figures 4 and 5).

Regarding claim 38, Esrig discloses the stage is a high-precision two-dimensional stage controlled by the computing device to avoid overlapping fields-of-view (column 4, lines 51-54: the stage 9 moves the module 23 so the objects under inspection are completely within the view of the camera 13 and there is no overlap between the field-of-view of the camera and that of the objects).

Regarding claim 18, Esrig discloses the computer program provides a graphical user interface operable to facilitate a user setting up and initiating the analysis, and to facilitate the user causing the report to be generated (monitor 15 provides a GUI).

8. Claims 12, 21, 32, and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esrig in view of Wallack and Mitsuyama, and further in view of U.S. Patent 6,151,408 by Oosawa.

Regarding claims 12, 32, 21, and 41, Esrig, Wallack, and Mitsuyama are silent to the color segmentation and recognition technique using a neural network and an associated rulebase to identify and classify the object.

Oosawa discloses a method for separating a region from a color image. In particular, Oosawa discloses segmenting a color region from an image utilizing a neural network and its associated rulebase (step 3, figure 1).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Esrig, Wallack, and Mitsuyama by Oosawa to utilize a neural network and associated

reulebase to identify and classify an object, as claimed, since Oosawa teaches that it is conventional to identify and classify color regions in an image using neural networks.

9. Claims 13, 22, 33, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Esrig in view of Wallack and Mitsuyama, and further in view of "Feature Extraction using Fuzzy Relations for Objects of Various Shapes" by Cho et al. ("Cho").

Regarding claims 13, 33, 22, and 42, Wallack discloses the object is a void and the shape feature segmentation and analysis technique is operable to extract the void from the image and to characterize the shape of the void by correlating a bright area of the void with a dark region of the void (see figure 3 of Wallack – showing that a void is extracted by examining the bright and dark regions of and around the void), and Esrig teaches that the bright area and the dark region are enhanced by the grazing angle of the illumination (see figure 11 of Esrig – showing that the illumination 29 impinges light on the sample at a graving angle, thereby enhancing the light and dark regions).

Wallack does not disclose that the shape of the void is extracted from the image using a fuzzy logic correlator, as claimed.

Cho discloses an object recognition system that identifies the shapes of objects in an image using fuzzy logic (see Abstract).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Esrig, Wallack, and Mitsuyama by Cho to characterize the shape of the void using fuzzy logic, as claimed, since Cho shows that it is conventional to utilize fuzzy logic to

characterize an object's shape and utilizing fuzzy logic in this manner increases the performance of an object recognition system (see Abstract).

(10) Response to Argument

Appellant presents five primary arguments in the Appeal Brief:

(1) the system of Esrig identifies internal defects rather than "surface features," and therefore, Esrig does not anticipate claims 1 and 23 (see pp. 11-14 of the Brief);

(2) Esrig is non-analogous art, and therefore, the rejections under 35 USC § 103(a) of claims 5, 7, 17, 27, and 37 are improper (see pp. 14-17 of the Brief);

(3) there is no motivation to combine Esrig and Jaber as proposed for claims 5, 17, 27, and 37, because modifying the system of Esrig to analyze surface features of concrete would render it unsatisfactory for its intended purpose (see pp. 17-20 of the Brief);

(4) Jaber teaches that a user manually views images of the concrete, and therefore, the combination of Esrig and Jaber does not teach "automatically conducting an analysis" of concrete as required for claims 5 and 27 (see pp. 21-23 of the Brief);

(5) there is no motivation to combine Wallack with Esrig for claims 9, 14, 29, and 34 (see pp. 23-24 of the Brief).

[The remaining remarks on pp. 24-28 of the Brief contain no new arguments.]

Response to Argument 1

Appellant is correct in the assertion that Esrig's emission microscopy is capable of detecting defects that are internal to an integrated circuit. However, Appellant has not demonstrated that Esrig's system detects only internal defects.

Esrig's typical device under inspection is a packaged IC "with the top removed" (col. 2, lines 59-61). Removing the top presumably allows the top of the actual circuit and any features thereon to be directly imaged. Esrig's imaging system is operative to detect light emitted from the circuit so that "defects wherever located in the chip can be discerned" (col. 5, lines 9-14). Examiner construes this statement to mean that Esrig's system is capable of detecting defects in an IC no matter where the defects may be located, such as on the surface of the IC or within one of the inner layers of the IC.

Appellant's arguments hinge on the premise that Esrig's system can locate only defects in the interior of an IC under inspection, and any defects that may be present on the surface of the IC would go undetected. Examiner respectfully submits that this is an unreasonable interpretation of Esrig's disclosure. Appellant has provided no persuasive evidence or rationale why Esrig's system is incapable of detecting surface defects on the top layer of an integrated circuit under inspection.

Response to Argument 2

Examiner respectfully disagrees with Appellant's assertion that Esrig constitutes non-analogous art. The disclosures of both Esrig and the present invention are directed to object inspection systems.

Not only are both disclosures for object inspection systems, but also the disclosed systems are nearly identical in their components. According to figure 1 of Esrig and figure 1 of the present invention (PI), both systems comprise:

- a stage on which an object to be inspected is placed (Esrig 9; PI 26);

- a microscope to magnify the object (Esrig 11; PI 24);
- a camera to capture images of the magnified object (Esrig 13; PI 28);
- a display for displaying the captured images (Esrig 15; PI computer monitor); and
- a computer for controlling the inspection process (Esrig 14; PI 30).

The primary difference between the two systems is what objects are to be inspected. Esrig's system is for inspecting ICs whereas the present invention is for inspecting concrete. The details of how to inspect these objects differ due to the inherently different characteristics of the objects. For example, Esrig includes an image intensifier 12 so that emitted light from a circuit can be detected. Such an intensifier is not utilized by the present invention because concrete does not emit light.

Notwithstanding these differences, the overall make-up of the two systems are sufficiently similar to the point where they can both be considered to reside in "the same field of endeavor" – systems for detecting defects in objects under inspection.

Response to Argument 3

Examiner respectfully disagrees with Appellant's assertion that modifying Esrig by Jaber in the manner proposed would render Esrig's system unsatisfactory for its intended purpose. The proposed combination would modify Esrig only to the extent necessary to inspect a piece of concrete rather than integrated circuit by including any logistics required for inspecting concrete rather than an integrated circuit.

The components of Esrig and Jaber's systems are nearly identical. According to figure 1 of Esrig and figure 1 of Jaber, both systems comprise:

- a stage on which an object to be inspected is placed (Esrig 9; Jaber 9);
- a microscope to magnify the object (Esrig 11; Jaber 11);
- a camera to capture images of the magnified object (Esrig 13; Jaber 13);
- a display for displaying the captured images (Esrig 15; Jaber 15); and
- a computer for controlling the inspection process (Esrig 14; Jaber 14).

Since the systems of both Esrig and Jaber are nearly identical and are used for the purposes of inspecting objects for defects, inspecting concrete rather than integrated circuits would not destroy the principle intended purpose of Esrig's system.

No undue experimentation would be required to enact such a modification since Jaber enables the inspection of concrete using a substantial equivalent of Esrig's system. Only obvious logistical changes would be required to change Esrig's system as proposed: Esrig's image intensifier 12 would be removed as unnecessary, and Jaber's concrete inspection software 26 and button box 16 would be included in order to effectively inspect concrete. Such logistical changes would have been readily apparent to and well within the reach of those skilled in the art, especially in light of Jaber's disclosure, which teaches how to inspect concrete using substantially the same inspection apparatus as that of Esrig.

Furthermore, the entire disclosure of Jaber provides the requisite motivation for the proposed combination insofar as Jaber discloses that, like integrated circuits, concrete is liable to

develop defects, and therefore, it is advantageous to inspect concrete in order to identify such defects for quality control purposes.

Response to Argument 4

Examiner respectfully disagrees with Appellant's assertion that the combination of Esrig and Jaber does not teach "automatically" conducting an analysis of a sample of concrete, as claimed, since Jaber's system relies on a user "manually view[ing]" images of the concrete generated by the system to identify characteristics of the concrete.

Jaber expressly teaches that his inspection method is automated via concrete inspection software 26: "[t]he present invention relates to a system and method for automatically determining the air-void content of hardened concrete..." (col. 1, lines 6-9 and col. 2, lines 31-35) (emphasis added). "[T]he concrete inspection software 26 utilizes the corrdinate data for the traverse lines to perform localized analysis of the specimen" (col. 5, lines 66-68).

Furthermore, it has been judicially recognized that providing means to automate a manual activity that accomplishes the same result is not sufficient to distinguish over the prior art. See *In re Venner* (citation omitted); MPEP § 2144.04. Thus, even if one were to consider Jaber's system not to be automated, such a deficiency would not render the proposed combination of Esrig and Jaber invalid.

Response to Argument 5

Examiner respectfully disagrees with Appellant's assertion that there is no motivation to combine Wallack with Esrig in the manner proposed. Claims 9, 14, 29, and 34 recite a number of

different image analysis techniques that are "included" in the analysis of the sample under inspection.

Esrig's inspection system is operative to identify defects by allowing an operator to "select possible defect bright spots" in an image of the sample, and then zoom in on the suspected defective area for a closer inspection (column 5, lines 15-21). Wallack, like Esrig, is directed to detecting defects in an object under inspection but relies on computer vision methods for detecting objects within a sample that are indicative of defects.

A defect object, such as shown in figure 3 of Wallack, is identified by performing a segmentation and recognition technique and a shape feature segmentation and analysis technique, as shown in figure 2. Wallack teaches that such techniques are advantageous for identifying objects representative of defects within an image, in accordance with Esrig's stated purpose of identifying "bright spots" within an inspection image that constitute defects.

Since Wallack's segmentation/recognition and shape feature segmentation/analysis techniques facilitate the identification of defect objects within an inspection image, and Esrig's system is directed towards identifying objects that are indicative of defects in inspection images, those skilled in the art would have recognized that Wallack's analysis techniques could have been advantageously incorporated into Esrig's system because utilization of these techniques would produce Esrig's desired results of detected potential defect areas in an effective and automated manner.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Colin LaRose

16 March 2006

Conferees:

Bhavesh Mehta

BHAVESH M. MEHTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

Joe Mancuso

JOSEPH MANCUSO
SUPERVISORY PATENT EXAMINER